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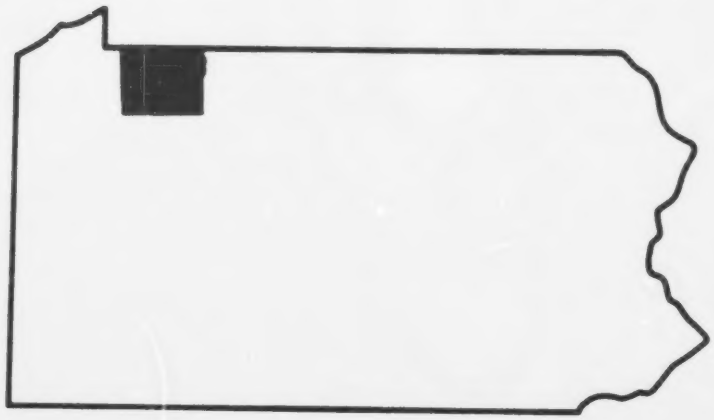
# FLOOD INSURANCE STUDY

## TOWNSHIP OF PINE GROVE, PENNSYLVANIA
## WARREN COUNTY



AUGUST 19, 1987

Federal Emergency Management Agency

COMMUNITY NUMBER - 422124

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NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
TOWNSHIP OF PINE GROVE, WARREN COUNTY. PENNSYLVANIA

# 1.0 INTRODUCTION

## 1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Township of Pine Grove, Warren County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

## 1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by the U. S. Army Corps of Engineers (COE), Pittsburgh District, for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-E-1153, Project Order No. 1, Amendment No. 20. This work was completed in February 1986.

## 1.3 Coordination

Initial coordination of this study involved public and incidental meetings with Township Officials, and Notice of Initiation letters. On December 1, 1983, these letters were sent to all Federal, State, County, and local government agencies and private firms that could provide information to be used for this study.

On July 26, 1983, an initial Consultation and Coordination Officer's (CCO) meeting was held between representatives of the Township of Pine Grove, FEMA, and the COE (the study contractor).

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On September 29, 1986, the study was reviewed at a final CCO meeting attended by representatives of the township, FEMA, and the study contractor.

## 2.0 AREA STUDIED

### 2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Township of Pine Grove, Warren County, Pennsylvania. The area of study is shown on the Vicinity Map (Figure 1).

The following streams in the township were studied by detailed methods: Conewango Creek, for its entire length within the community; Akeley Run, from its confluence with Conewango Creek to approximately 2.3 miles upstream of the confluence; and North Branch Akeley Run, from its confluence with Conewango Creek to approximately 4.5 miles upstream of the confluence. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through February 1991.

The following streams were studied by approximate methods: Middlefield Run, Reynolds Run, Priest Hollow, Vanarsdale Run, Rhine Run, Peterson Hollow, Johnny Run, Storehouse Run, Wiltsie Run, and the remaining portions of Akeley Run and North Branch Akeley Run. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Township of Pine Grove.

### 2.2 Community Description

The Township of Pine Grove is located in northeastern Warren County in northwestern Pennsylvania. The total land area contained within the township is 40.3 square miles. The township is bordered by the Towns of Carroll, Kiantone, and South Valley, New York, to the north; the Township of Elk to the east; the Townships of Conewango and Glade to the south; and the Township of Farmington to the west. According to the U. S. Bureau of the Census, the population of Pine Grove was 2,576 in 1980, a 14.2 percent increase from 2,256 in 1970 (Reference 1).

Conewango Creek, with a drainage area of 898 square miles at its mouth, has its source in the northwestern part of Cattaraugus County, New York. It flows in a generally southwestern direction through Cattaraugus and Chautauqua Counties in New York and Warren County, Pennsylvania, for a distance of approximately 68 miles to its confluence with the Allegheny River at Warren, Pennsylvania. The average bed slope of Conewango Creek



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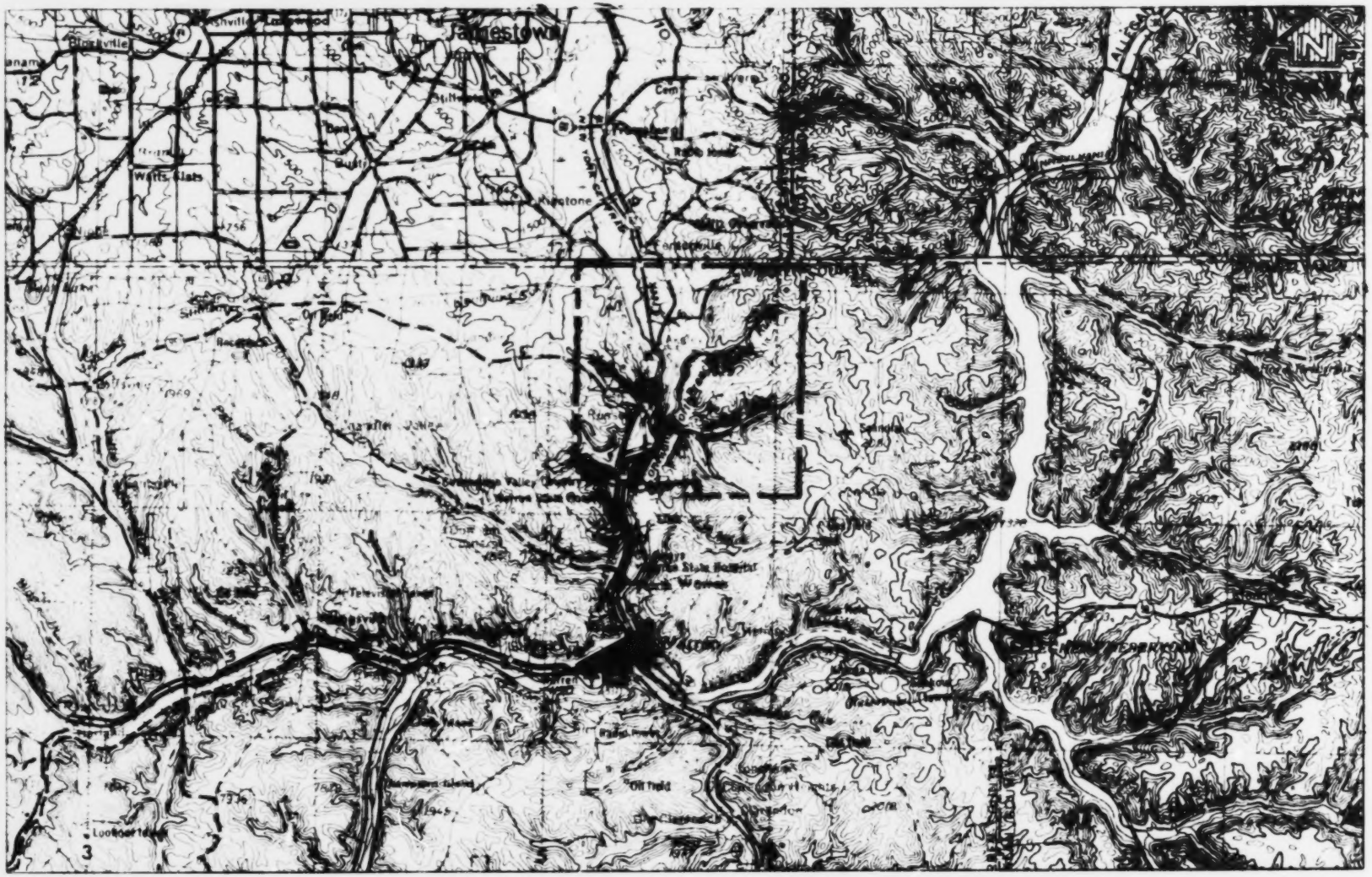


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

**TOWNSHIP OF PINE GROVE, PA**

**(WARREN CO.)**

APPROXIMATE SCALE

4 0 4 8 12 MILES

**VICINITY MAP**

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within the study area is 3.8 feet per mile. Local relief above the stream valley varies from a low of 1,180 feet to an average hilltop elevation of 1,800 feet. The valley floor varies in width from 200 feet near the City of Russell, Pennsylvania, to 2,500 feet near the Pennsylvania state boundary.

Akeley Run, with a drainage area of 19.0 square miles at its confluence with Conewango Creek, has its source near the Township of Pine Grove corporate limits, in the northeastern portion of Warren County. It flows in a southwestern direction through Warren County for a distance of 3.4 miles where it meets Conewango Creek at the City of Russell, Pennsylvania. The study reach extends a distance of 2.4 miles and meets Conewango Creek at mile 7.7. The average slope of Akeley Run in the study area is 62.0 feet per mile. Local relief varies from a low of 1,220 feet to an average hilltop elevation of 1,900 feet. The valley floor varies in width from 100 to 300 feet.

North Branch Akeley Run, with a drainage area of 10.0 square miles at its confluence with Conewango Creek, has its source near Cable Hollow, Pennsylvania, in the northeastern portion of Warren County. It flows through Warren County for a distance of 4.9 miles to its confluence with Conewango Creek north of the City of Russell. The average slope of North Branch Akeley Run in the study area is 70.0 feet per mile. Local relief varies from a low of 1,220 feet to an average hilltop elevation of 1,600 feet. The valley floor varies in width from 100 feet to 300 feet.

The climate for this area is temperate with seasonal variation in temperature. The Township of Pine Grove is geographically located in a region of both polar and tropical air mass activity, subject to continental and maritime invasion. The weather is usually moderate but may have rapid changes resulting from frontal air mass movements. Temperatures range from an average of 27 degrees Fahrenheit (°F) in February to an average of 71°F in July. Measurable precipitation occurs an average of 149 days a year and amounts to an average of 42 inches.

## 2.3 Principal Flood Problems

Major floods have occurred in the study reach of Conewango Creek at various times of the year. However, the main flood season is usually December through April. Most of the floods during this period are the result of heavy rain and snowmelt. The maximum flood of record occurred in April 1947 and was the result of snowmelt and heavy rain. The March 1936 flood was the highest known historical flood prior to the period of record. The following tabulation shows major floods on Conewango Creek as measured at the U. S. Geological Survey (USGS) recording gaging station No. 03015000 at the City of Russell, Pennsylvania, since 1940.



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| Date of Crest | Actual Stage (Feet) | Elevation (Feet) | Discharge (cfs) |
|---|---|---|---|
| March 27-30, 1936 | 10.90 | 1,232.67 | 14,600 |
| April 7, 1947 | 10.69 | 1,232.46 | 14,400 |
| March 19, 1942 | 10.68 | 1,232.45 | 13,700 |
| March 9, 1956 | 10.55 | 1,232.32 | 14,100 |
| February 22, 1981 | 10.30 | 1,232.07 | 13,300 |
| February 23, 1976 | 10.04 | 1,231.81 | 12,500 |
| April 4, 1940 | 9.44 | 1,231.21 | 10,700 |
| April 2, 1960 | 9.39 | 1,231.16 | 11,000 |
| March 23, 1948 | 9.30 | 1,231.07 | 10,700 |

Note: Gage Zero = 1,221.77 feet

Major floods may occur on Akeley Run and North Branch Akeley Run at various times throughout the year. However, the main flood season is usually during the months of June through October. Akeley Run and North Branch Akeley Run are more susceptible to flash flooding from high intensity, short duration thunderstorms than from prolonged winter-spring rains combined with snowmelt.

### 2.4 Flood Protection Measures

The Soil Conservation Service (SCS) has constructed eight of a planned 20 floodwater retarding dams in the extreme headwaters of Conewango Creek. However, they do not cause any reduction in flow on Conewango Creek within the township. There are no flood control structures or local flood protection projects on Akeley Run and North Branch Akeley Run.

## 3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at



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short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

## 3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

Natural discharge-frequency curves on Conewango Creek were developed following the standard log-Pearson Type III analysis as outlined by the USGS in Bulletin No. 17B (Reference 2). The stage discharge records used in the analysis of Conewango Creek were obtained from the USGS gaging station No. 03015000 at the City of Russell, covering a 44-year period from 1940 through 1983. The gage at the city is operated by the USGS in cooperation with the COE.

There are no gage or stream flow records available for Akeley Run or North Branch Akeley Run. Flows for the 10-, 50-, 100-, and 500-year floods were developed using the multiple regression formulas based on factors determined from a COE study of small streams in Pennsylvania (Reference 3). The factors used were drainage area, stream length, stream slope, and basin shape.

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

| FLOODING SOURCE AND LOCATION | DRAINAGE AREA (sq. miles) | PEAK DISCHARGES (cfs) 10-YEAR | 50-YEAR | 100-YEAR | 500-YEAR |
|---|---|---|---|---|---|
| CONEWANGO CREEK | | | | | |
| Upstream of confluence with Johnny Run | 766.0 | 11,600 | 14,800 | 16,300 | 19,400 |
| AKELEY RUN | | | | | |
| At confluence with Conewango Creek | 19.0 | 2,190 | 3,800 | 4,800 | 7,200 |

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TABLE 1 - SUMMARY OF DISCHARGES - continued

| FLOODING SOURCE AND LOCATION | DRAINAGE AREA (sq. miles) | PEAK DISCHARGES (cfs) 10-YEAR | 50-YEAR | 100-YEAR | 500-YEAR |
|---|---|---|---|---|---|
| NORTH BRANCH AKELEY RUN | | | | | |
| At confluence with Conewango Creek | 10.0 | 1,500 | 2,600 | 3,300 | 5,100 |

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-section data for Conewango Creek, Akeley Run, and North Branch Akeley Run were obtained from topographic maps compiled from aerial photographs at a scale of 1:4,800 with a contour interval of 4 feet (Reference 4). All bridges were field surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 5). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

Starting water-surface elevations for Conewango Creek were based on a continuation of profiles taken from the Flood Insurance Study for the Borough of Warren (Reference 6). Starting water-surface elevations for Akeley Run and North Branch Akeley Run were obtained from a rating curve on Conewango Creek located approximately at mile 7.65. The final frequency profiles were determined by combining the effects of flooding from Conewango Creek and Akeley and North Branch Akeley Runs, which were assumed to be independent.

Roughness coefficients (Manning's "n") for Conewango Creek were chosen on the basis of field inspection and verification of roughness requirements to reproduce profiles for known floods for which high-water marks were obtained and flow quantities were measured or easily calculated. For Conewango Creek, the well defined flood of June 1972 was successfully reproduced using the coefficients shown below. For Akeley Run and North



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Branch Akeley Run, the "n" values were based on observed characteristics of each stream. The following tabulation shows channel and overbank "n" values for the streams studied by detailed methods:

| Stream | Channel "n" | Overbank "n" |
|---|---|---|
| Conewango Creek | 0.024-0.047 | 0.060-0.080 |
| Akeley Run | 0.035-0.040 | 0.070-0.080 |
| North Branch Akeley Run | 0.030-0.035 | 0.070-0.080 |

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

## 4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

### 4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the streams studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4,800 with a contour interval of 4 feet (Reference 4).

For the streams studied by approximate methods, the 100-year flood boundary was delineated using the Flood Hazard Boundary Map for the Township of Pine Grove (Reference 7).



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The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2).

## 4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 2). The computed floodways are shown on the Flood Insurance Rate Map (Exhibit 2). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot



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| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE |
| | | | | | (FEET NGVD) | | | |
| Conewango Creek | | | | | | | | |
| A | 6.420[1] | 238 | 2,510 | 6.7 | 1,219.5 | 1,219.5 | 1,220.1 | 0.6 |
| B | 6.950[1] | 352 | 3,002 | 5.6 | 1,223.5 | 1,223.5 | 1,224.0 | 0.5 |
| C | 7.330[1] | 236 | 1,792 | 9.4 | 1,225.8 | 1,225.8 | 1,225.9 | 0.1 |
| D | 8.423[1] | 294 | 2,970 | 5.7 | 1,236.0 | 1,236.0 | 1,236.6 | 0.6 |
| E | 8.960[1] | 204 | 3,870 | 4.2 | 1,238.3 | 1,238.3 | 1,239.1 | 0.8 |
| F | 10.005[1] | 433 | 4,717 | 3.5 | 1,240.4 | 1,240.4 | 1,241.4 | 1.0 |
| G | 10.481[1] | 507 | 5,417 | 3.0 | 1,241.3 | 1,241.3 | 1,242.3 | 1.0 |
| H | 11.022[1] | 617 | 6,389 | 2.6 | 1,242.2 | 1,242.2 | 1,243.2 | 1.0 |
| I | 12.235[1] | 2,271 | 20,487 | 0.8 | 1,242.9 | 1,242.9 | 1,243.9 | 1.0 |
| J | 12.740[1] | 2,851 | 27,659 | 0.6 | 1,243.1 | 1,243.1 | 1,244.1 | 1.0 |
| Akeley Run | | | | | | | | |
| A | 255[2] | 400 | 1,174 | 4.1 | 1,228.5 | 1,227.1[3] | 1,227.9 | 0.8 |
| B | 2,125[2] | 117 | 470 | 10.2 | 1,246.8 | 1,246.8 | 1,247.4 | 0.6 |
| C | 3,489[2] | 149 | 545 | 8.8 | 1,256.6 | 1,256.6 | 1,256.6 | 0.0 |
| D | 5,499[2] | 78 | 382 | 12.6 | 1,279.4 | 1,279.4 | 1,280.2 | 0.8 |
| E | 7,339[2] | 139 | 449 | 7.9 | 1,299.6 | 1,299.6 | 1,299.7 | 0.1 |
| F | 8,360[2] | 97 | 351 | 10.1 | 1,312.0 | 1,312.0 | 1,312.0 | 0.0 |
| G | 9,815[2] | 69 | 361 | 9.8 | 1,331.4 | 1,331.4 | 1,332.2 | 0.8 |
| H | 11,185[2] | 179 | 525 | 6.7 | 1,351.7 | 1,351.7 | 1,352.0 | 0.3 |

[1]Miles above confluence with Allegheny River

[2]Feet above confluence with Conewango Creek

[3]Elevation computed without consideration of backwater effects from Conewango Creek

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

**TOWNSHIP OF PINE GROVE, PA**
**(WARREN CO.)**

**FLOODWAY DATA**

**CONEWANGO CREEK - AKELEY RUN**

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY | WITHOUT FLOODWAY | WITH FLOODWAY | INCREASE |
| | | | | | (FEET NGVD) | | | |
| North Branch Akeley Run | | | | | | | | |
| A | 250 | 243 | 592 | 5.6 | 1,229.3 | 1,228.3[2] | 1,229.1 | 0.8 |
| B | 2,055 | 250 | 595 | 5.5 | 1,246.3 | 1,246.3 | 1,246.5 | 0.2 |
| C | 2,950 | 164 | 526 | 6.3 | 1,249.5 | 1,249.5 | 1,249.9 | 0.4 |
| D | 4,825 | 66 | 280 | 11.8 | 1,270.2 | 1,270.2 | 1,270.7 | 0.5 |
| E | 6,935 | 61 | 286 | 11.5 | 1,294.3 | 1,294.3 | 1,295.0 | 0.7 |
| F | 8,680 | 78 | 297 | 11.1 | 1,318.8 | 1,318.8 | 1,319.0 | 0.2 |
| G | 12,060 | 110 | 395 | 8.4 | 1,359.7 | 1,359.7 | 1,359.8 | 0.1 |
| H | 14,830 | 64 | 278 | 11.9 | 1,396.1 | 1,396.1 | 1,396.1 | 0.0 |
| I | 16,970 | 52 | 295 | 11.2 | 1,423.3 | 1,423.3 | 1,424.3 | 1.0 |
| J | 19,170 | 79 | 267 | 10.5 | 1,451.0 | 1,451.0 | 1,451.3 | 0.3 |
| K | 20,400 | 63 | 259 | 10.8 | 1,462.3 | 1,462.3 | 1,462.7 | 0.4 |
| L | 22,110 | 49 | 164 | 10.5 | 1,486.0 | 1,486.0 | 1,486.0 | 0.0 |
| M | 24,170 | 55 | 170 | 10.1 | 1,532.9 | 1,532.9 | 1,532.9 | 0.0 |

[1]Feet above confluence with Conewango Creek

[2]Elevation computed without consideration of backwater effects from Conewango Creek

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

**TOWNSHIP OF PINE GROVE, PA**
**(WARREN CO.)**

**FLOODWAY DATA**

**NORTH BRANCH AKELEY RUN**

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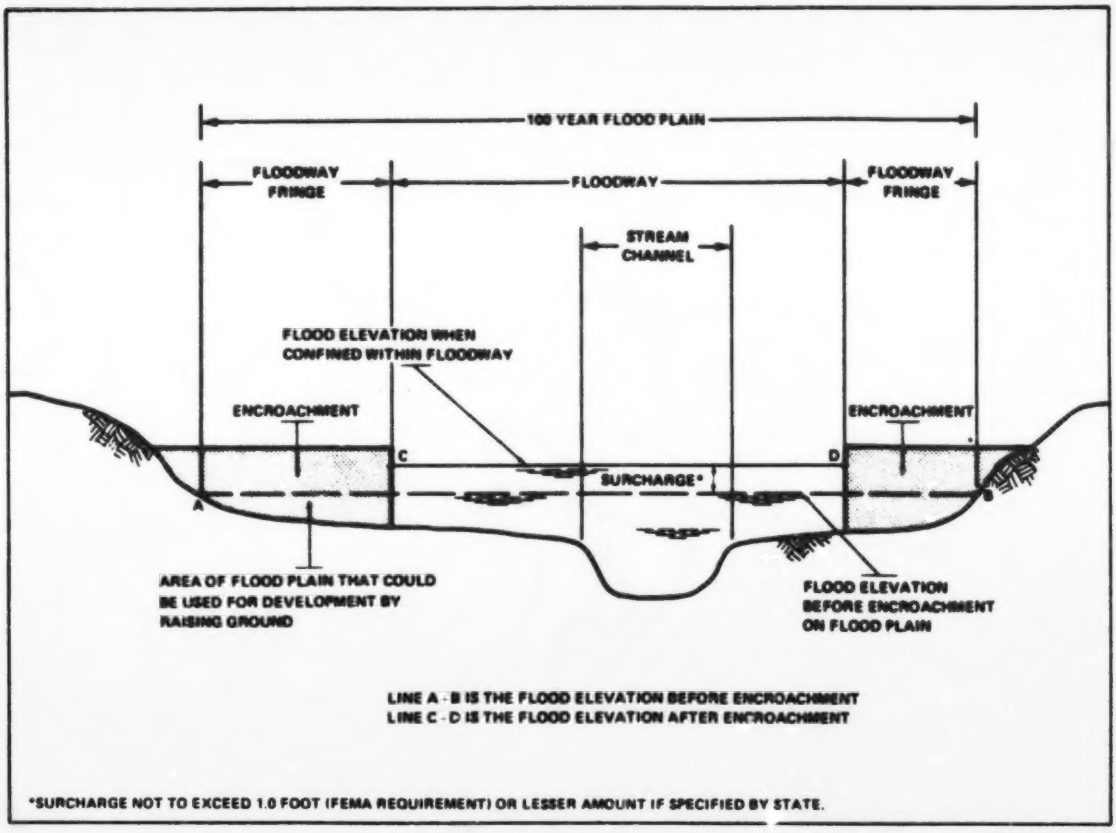
at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC

Figure 2

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 2 for certain downstream cross sections of Akeley Run and North Branch Akeley Run are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

## 5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:



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Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.



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Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

## 6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

## 7.0 OTHER STUDIES

The COE has published a Flood Plain Information Report for Warren County, Pennsylvania (Reference 8). That report concerns flooding of the Allegheny River.

Flood Insurance Studies for the Townships of Glade and Conewango, Pennsylvania, are currently being prepared (References 9 and 10). The results of those studies will be in exact agreement with the results of this study.



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Flood Insurance Studies for the Townships of Farmington and Elk, Pennsylvania, and the Town of Kiantone, New York, have been published (References 11, 12, and 13). The results of this study are in exact agreement with the results of those studies.

Due to its more detailed nature, this Flood Insurance Study supersedes the Flood Hazard Boundary Map for the Township of Pine Grove (Reference 7).

## 8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

## 9.0 BIBLIOGRAPHY AND REFERENCES


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2. U. S. Department of the Interior, Geological Survey, Office of Water Data Collection, Interagency Advisory Committee on Water Data, "Guidelines for Determining Flood Flow Frequency," Bulletin 17B, Reston, Virginia, Revised September 1981.

3. U. S. Army Corps of Engineers, Pittsburgh District, "Untitled Regression Data," Pittsburgh, Pennsylvania, 1975.

4. L. Robert Kimball and Associates of Ebensburg, Pennsylvania, Topographic Maps Compiled from Aerial Photographs Taken in February, 1984, Scale 1:4,800, Contour Interval 4 Feet: Pine Grove, Pennsylvania, February 1984.

5. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, October 1973.

6. Federal Emergency Management Agency, Flood Insurance Study, Borough of Warren, Warren County, Pennsylvania (Unpublished).

7. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Township of Pine Grove, Warren County, Pennsylvania, January 24, 1975.




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8. U. S. Army Corps of Engineers, Pittsburgh District, Flood Plain Information Report, Warren County, Pennsylvania, Pittsburgh, Pennsylvania, 1975.

9. Federal Emergency Management Agency, Flood Insurance Study, Township of Glade, Warren County, Pennsylvania (Unpublished).

10. Federal Emergency Management Agency, Flood Insurance Study, Township of Conewango, Warren County, Pennsylvania (Unpublished).

11. Federal Emergency Management Agency, Flood Insurance Study, Township of Farmington, Warren County, Pennsylvania, Washington, D. C., May 15, 1985.

12. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Township of Elk, Warren County, Pennsylvania, Washington, D. C., June 30, 1976.

13. Federal Emergency Management Agency, Flood Insurance Study, Town of Kiantone, Chautauqua County, New York, Washington, D. C., April 1, 1983.

Water Resources Council, Flood Plain Management Guidelines for Implementing Executive Order 11988, February 1978.



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EXHIBIT 3 - ELEVATION REFERENCE MARKS

| Reference Mark | FIRM Panel | Elevation (Feet NGVD) | Description of Location |
|---|---|---|---|
| RM 1 | 05 | 1,287.00 | PDH disk set on downstream southeast wing wall of U. S. Route 358 bridge over Wiltsie Run. |
| RM 2 | 05 | 1,240.96 | USGS disk stamped 1241 ADJ 1903 set on bridge seat of downstream southeast abutment of U. S. Route 62 bridge over Conewango Creek. |
| RM 3 | 05 | 1,450.47 | L cut on downstream southwest headwall of State Route 329 culvert over small stream, approximately 0.53 mile east of intersection of U. S. Route 62. |
| RM 4 | 10 | 1,573.91 | Bolt set at center of downstream side of culvert of State Route 588 bridge over North Branch Akeley Run. |
| RM 5 | 15 | 1,239.37 | USC & GS disk stamped L65-Reset 1937 set on top of upstream southeast wing wall of Hungry Hollow Road bridge over Conewango Creek. |
| RM 6 | 15 | 1,223.52 | USC & GS disk stamped R65-1935 set on top of upstream northwest concrete abutment of abandoned CONRAIL bridge over Conewango Creek. |
| RM 7 | 15 | 1,246.31 | L cut on upstream northwest concrete wing wall of Hungry Hollow Bridge over North Branch Akeley Run. |



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EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

| Reference Mark | FIRM Panel | Elevation (Feet NGVD) | Description of Location |
|---|---|---|---|
| RM 8 | 15 | 1,252.65 | U cut on top of downstream southwest wing wall of Big Four Road bridge over Akeley Run. |
| RM 9 | 15 | 1,304.72 | L cut on top of upstream northeast concrete wing wall on Egypt Hollow Road bridge over Akeley Run. |
| RM 10 | 15 | 1,374.52 | USGS disk stamped Yz4 1952 set on upstream southeast wing wall of Hungry Hollow Road bridge over Akeley Run, approximately 2.23 miles east of the City of Russell on LR 61038. |



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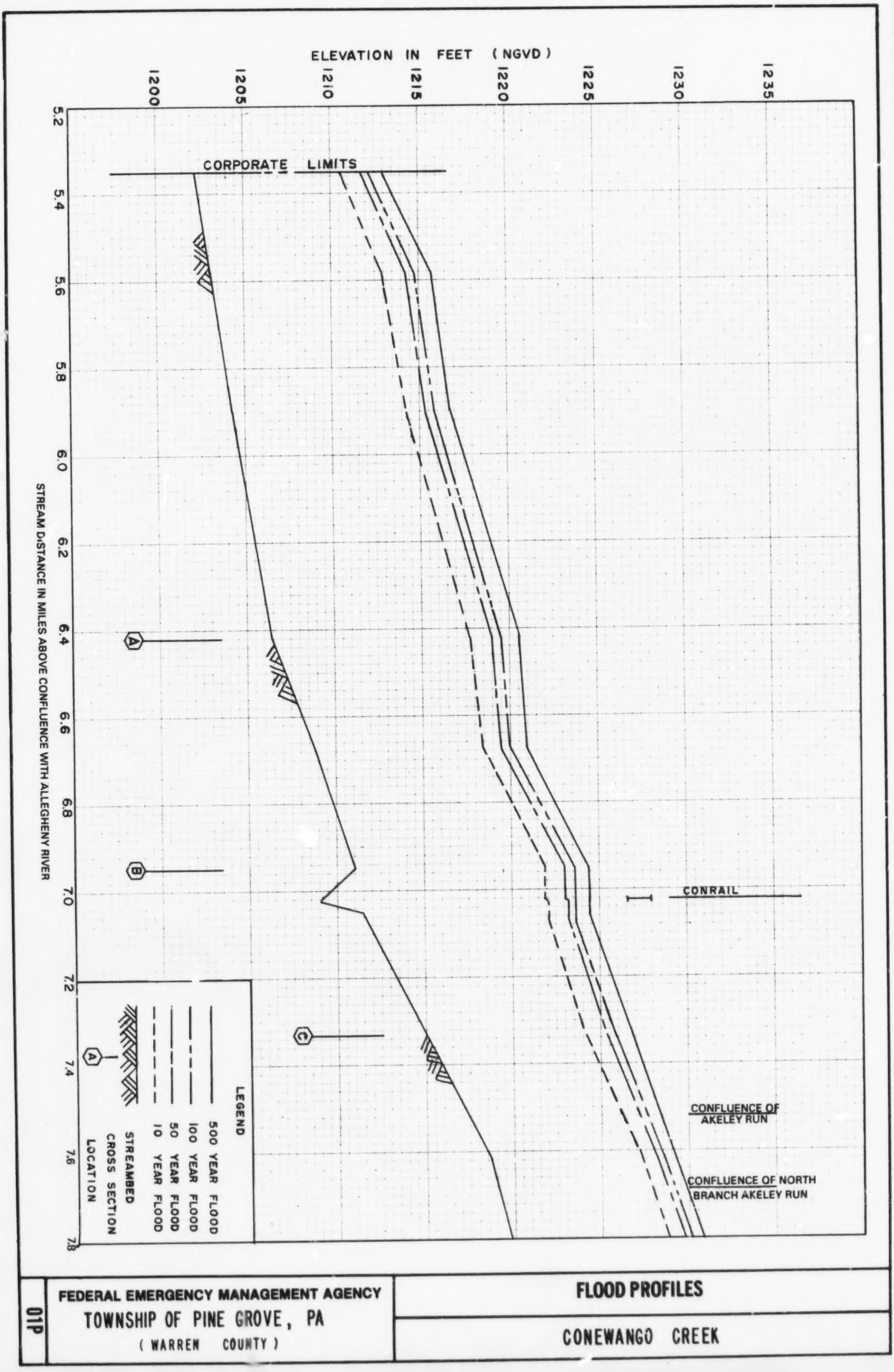


| | | |
|---|---|---|
| 01P | FEDERAL EMERGENCY MANAGEMENT AGENCY<br>TOWNSHIP OF PINE GROVE, PA<br>( WARREN COUNTY ) | FLOOD PROFILES<br>CONEWANGO CREEK |



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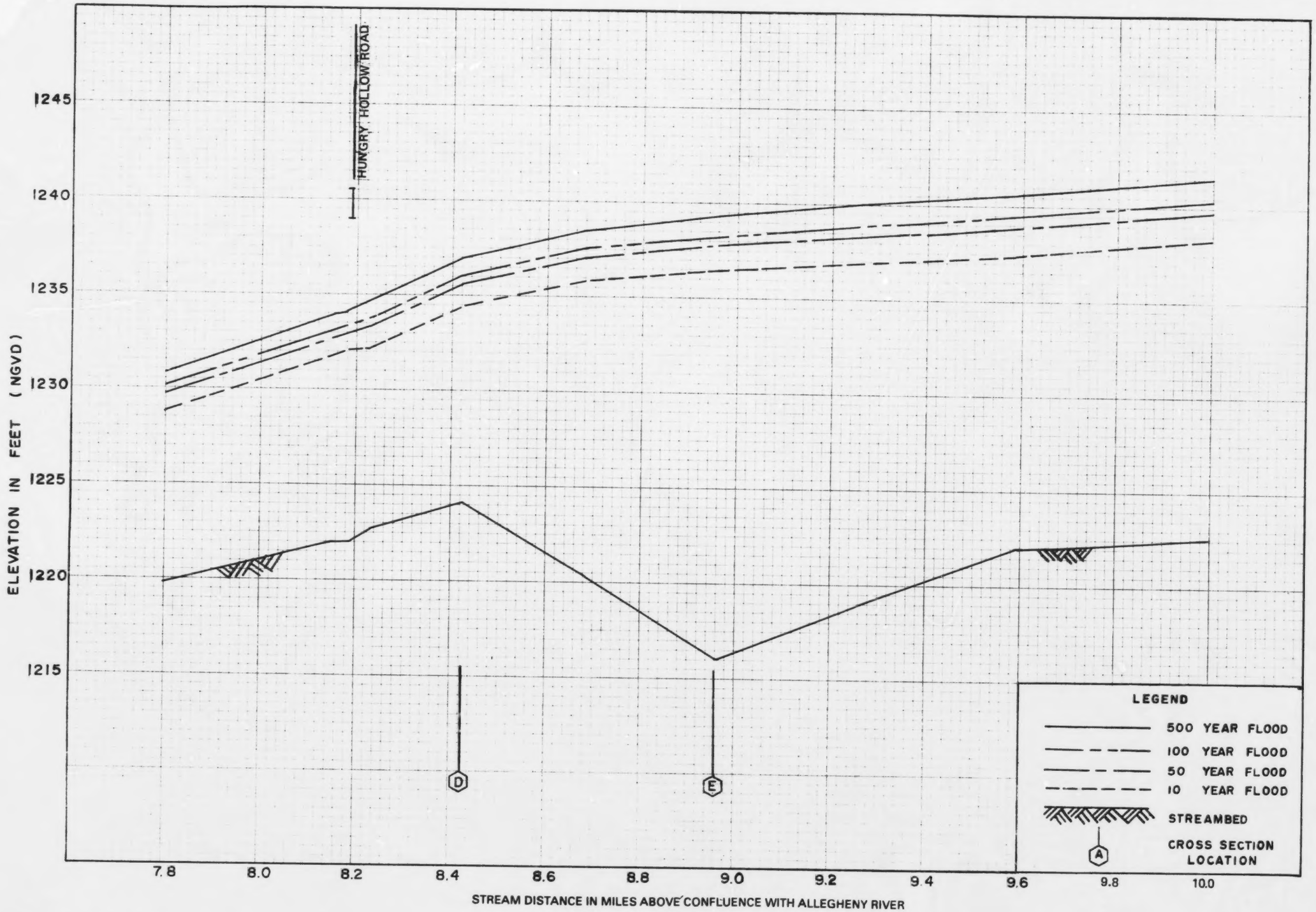


FLOOD PROFILES

CONEWANGO CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PINE GROVE, PA

( WARREN COUNTY )

02P



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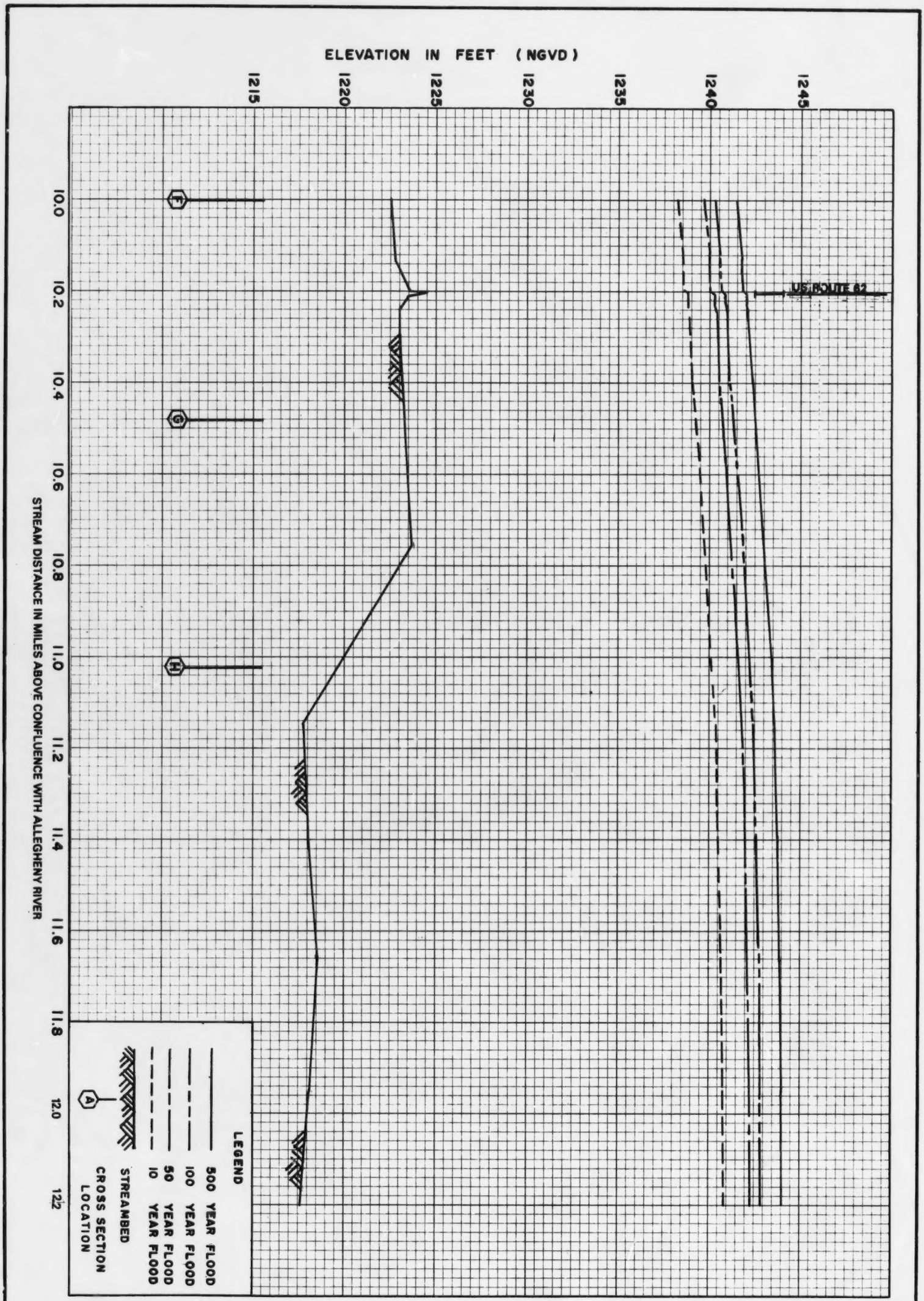


03P

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PINE GROVE, PA

(WARREN COUNTY)

**FLOOD PROFILES**

CONEWANGO CREEK

21

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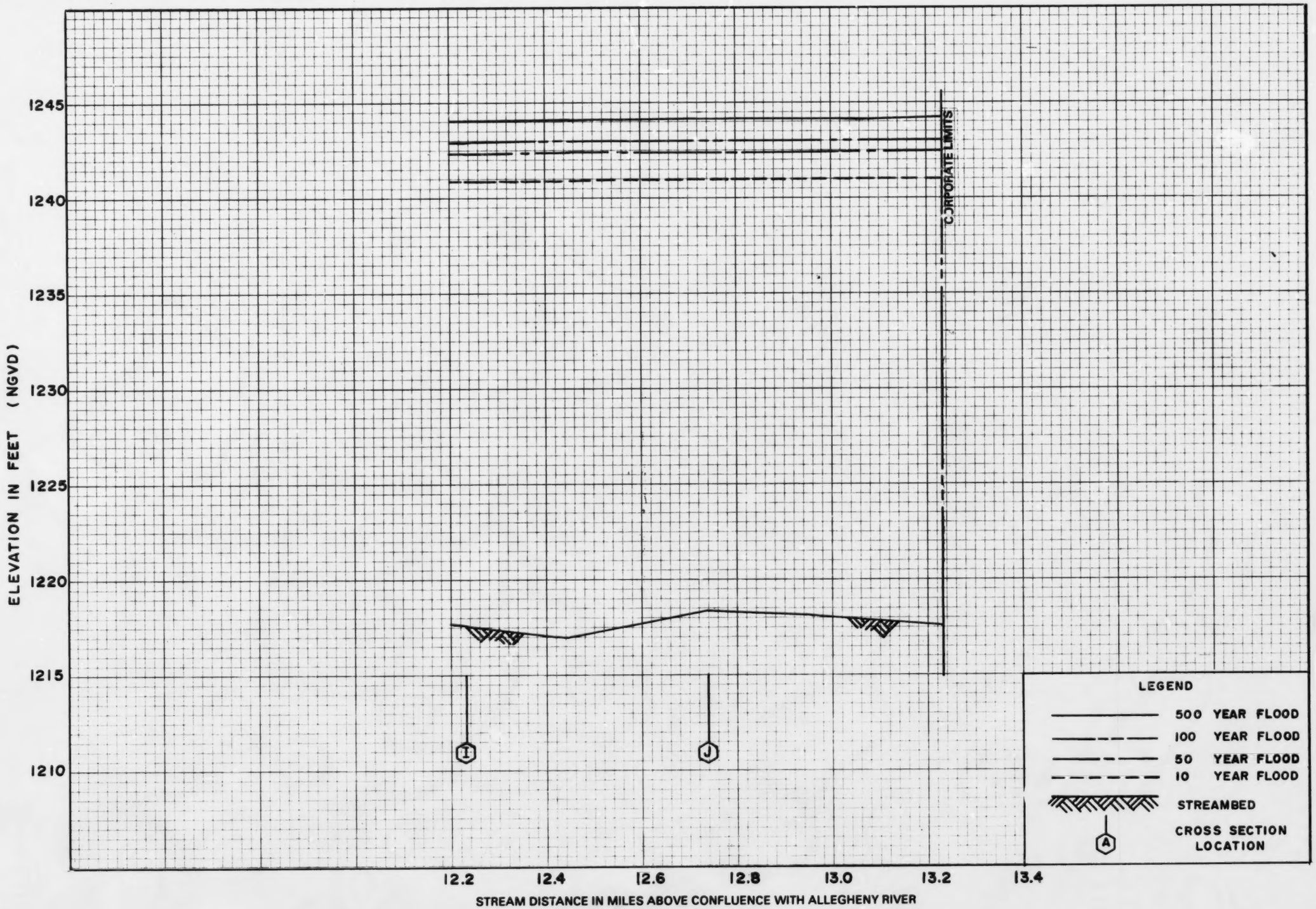


FLOOD PROFILES

CONEWANGO CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PINE GROVE, PA

(WARREN COUNTY)

04P



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FLOOD PROFILES

AKELEY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PINE GROVE, PA

( WARREN COUNTY )

05P



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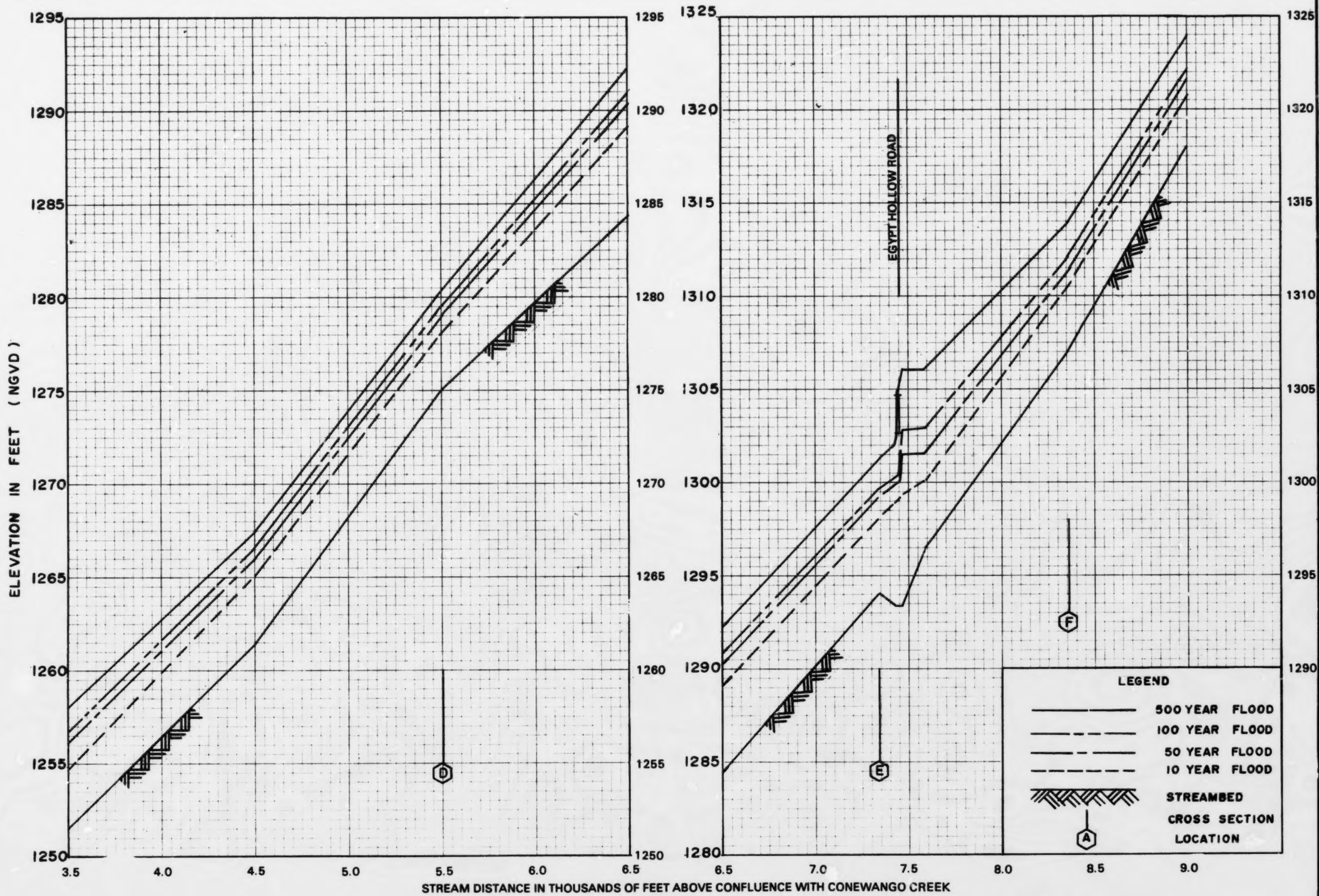


**FLOOD PROFILES**

AKELEY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PINE GROVE, PA

( WARREN COUNTY )

06P



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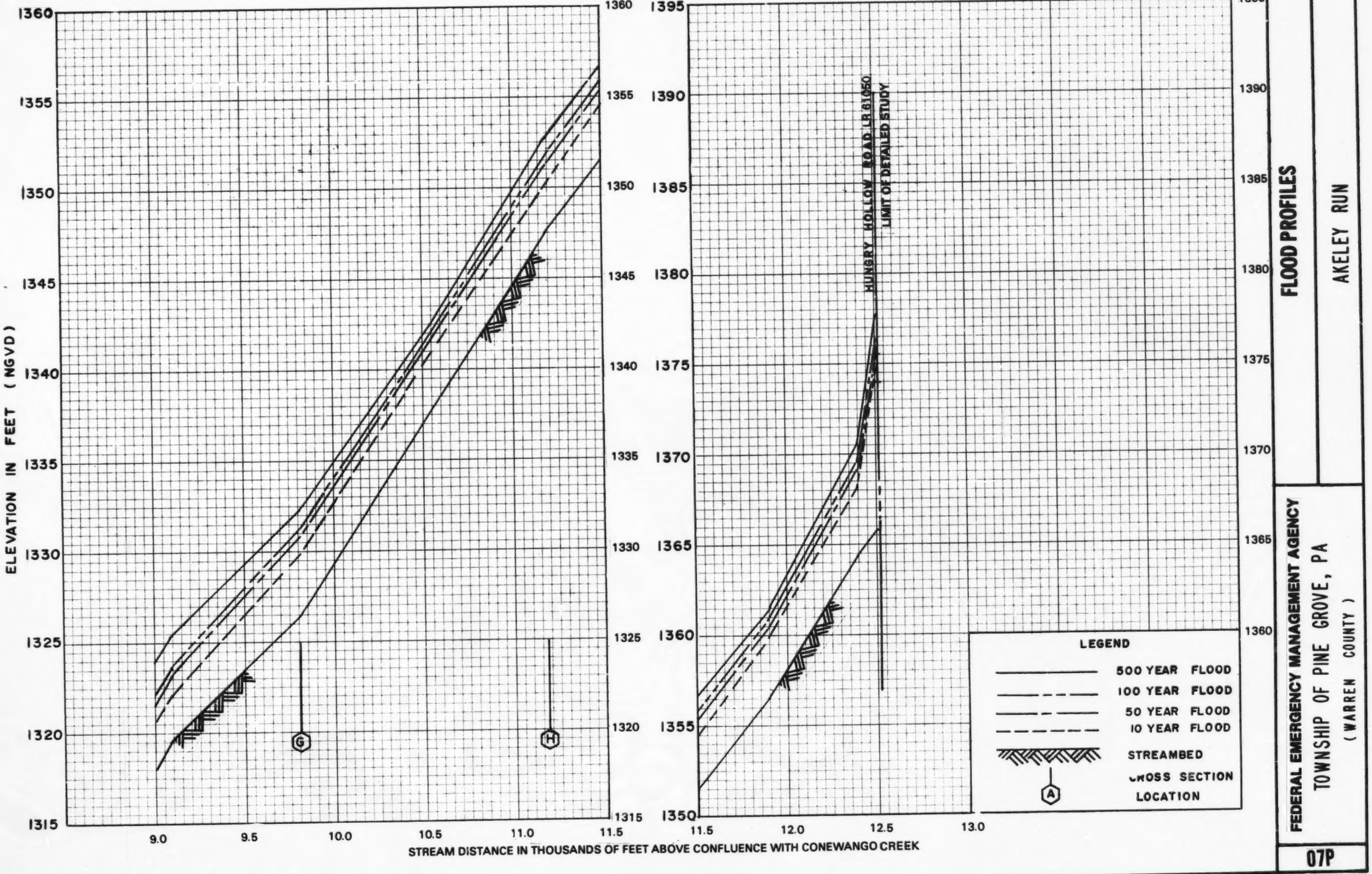


FLOOD PROFILES

AKELEY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PINE GROVE, PA

( WARREN COUNTY )

07P



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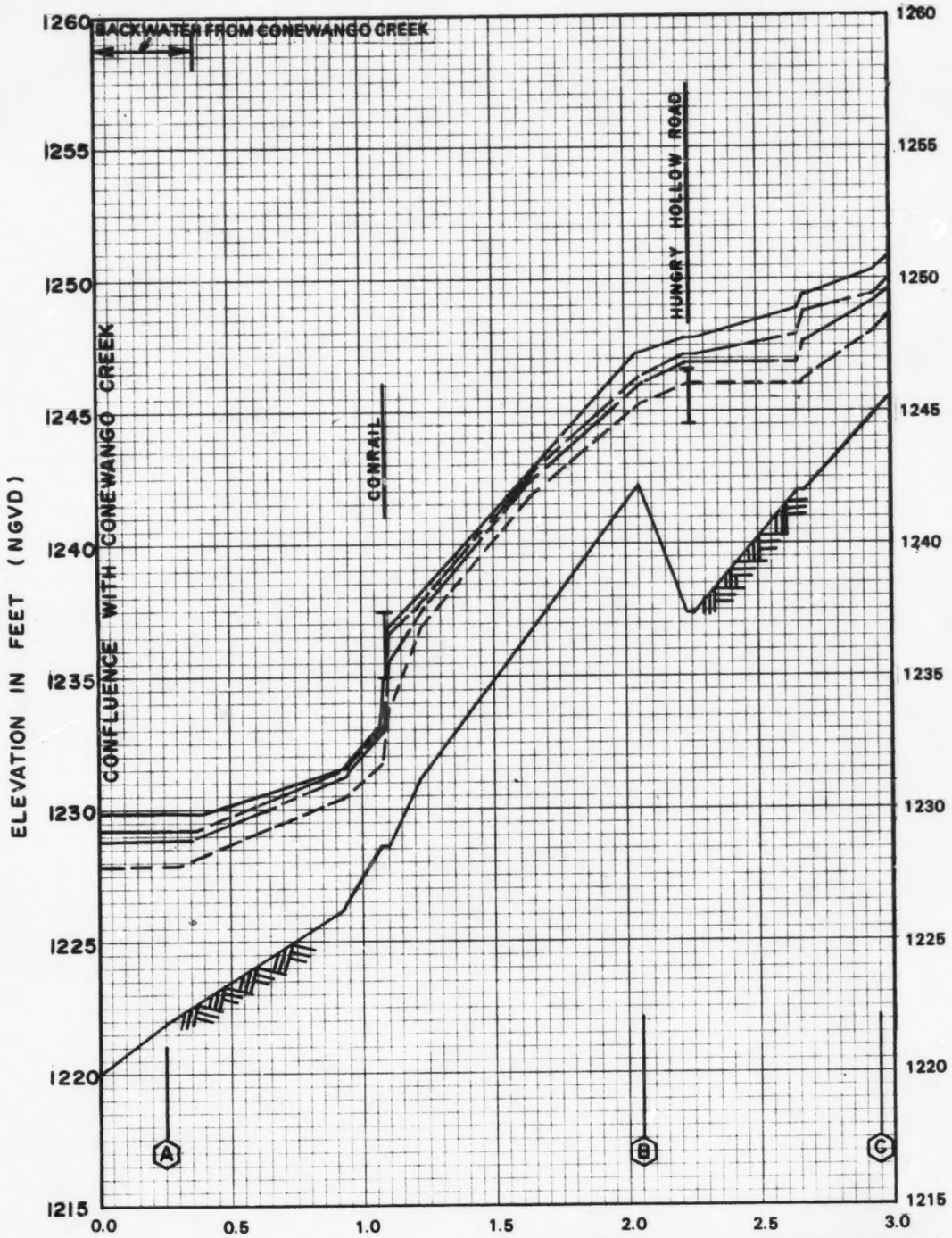


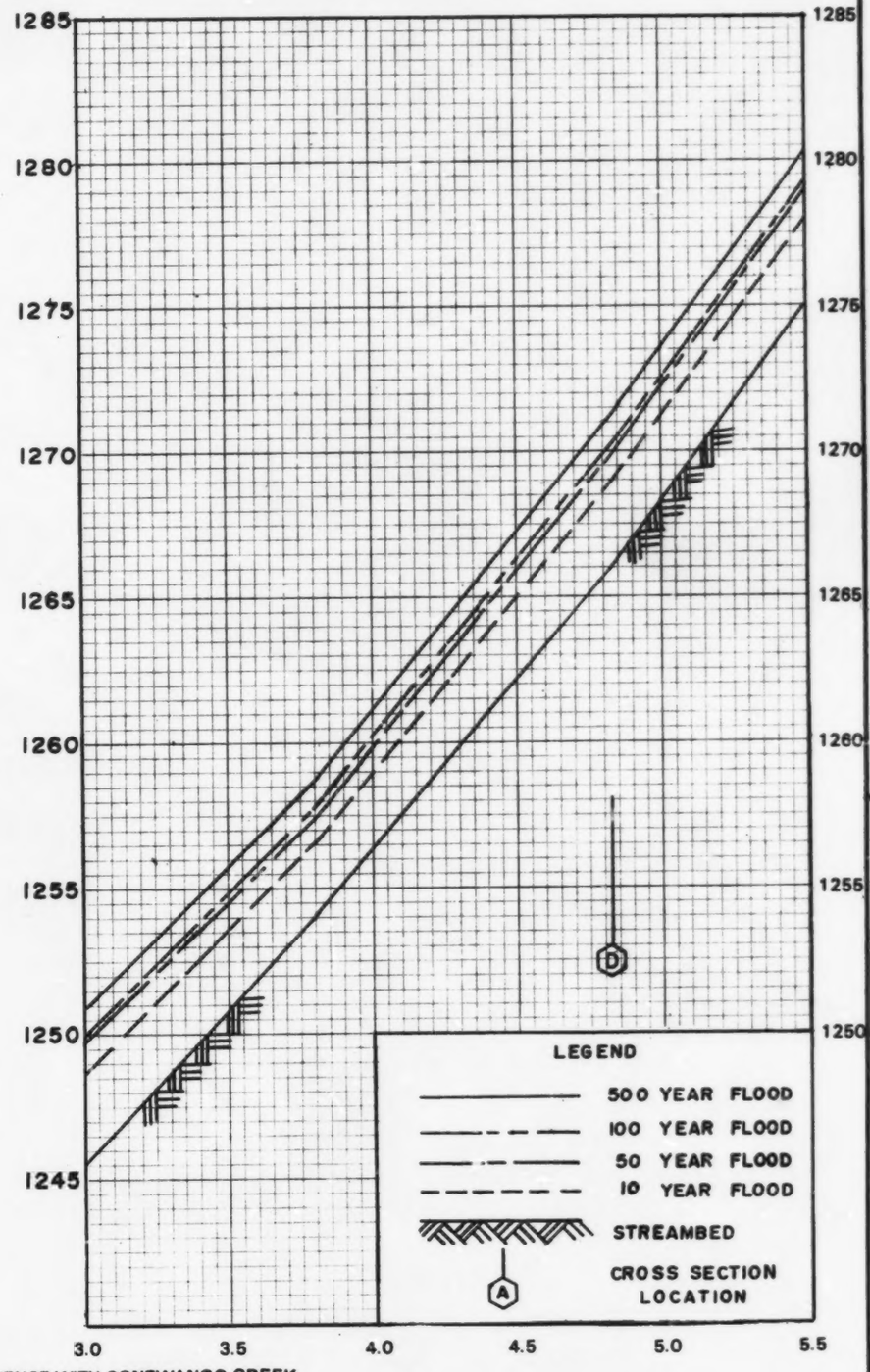


STREAM DISTANCE IN THOUSANDS OF FEET ABOVE CONFLUENCE WITH CONEWANGO CREEK

FLOOD PROFILES

NORTH BRANCH AKELEY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PINE GROVE, PA

( WARREN COUNTY )

08P



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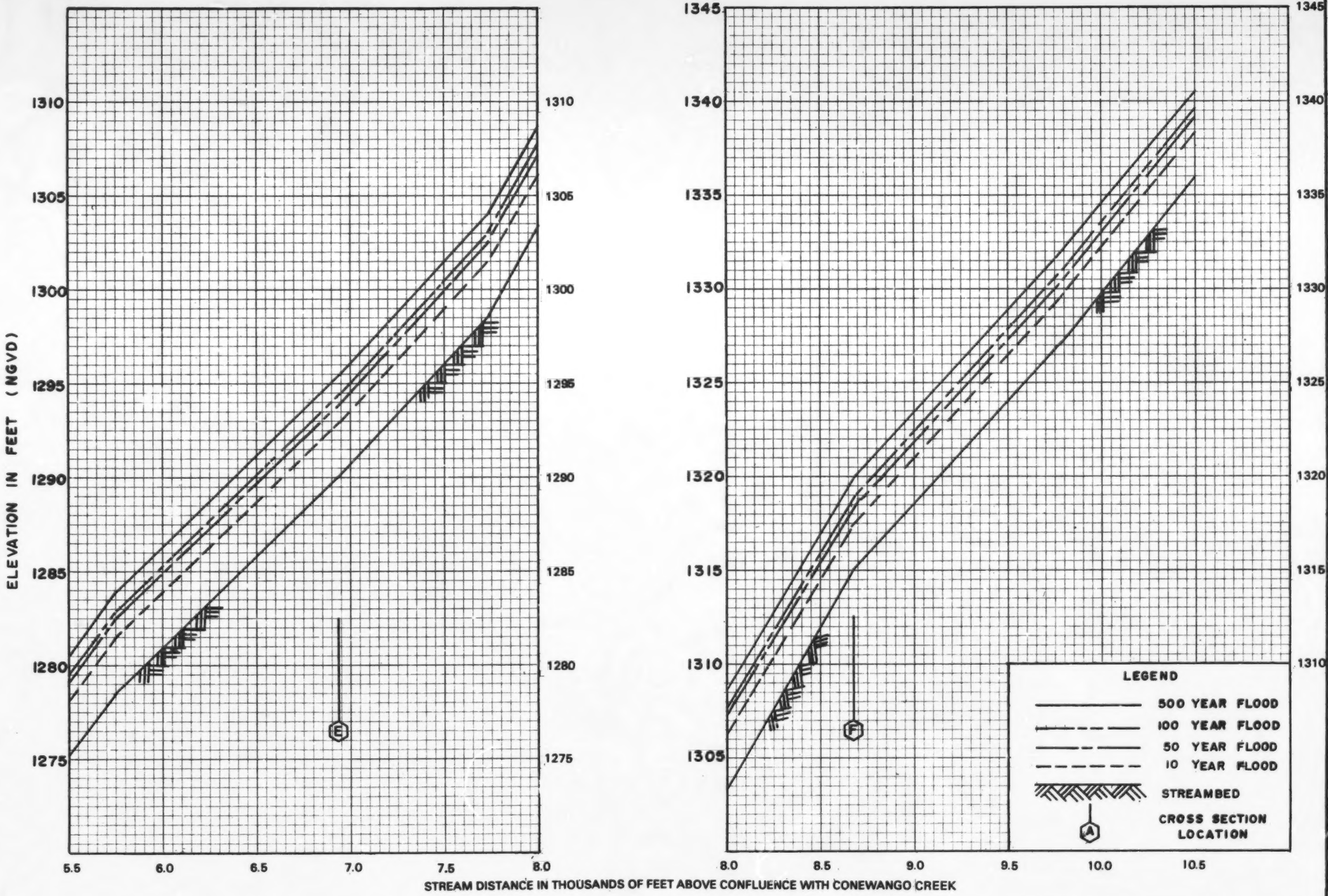


FLOOD PROFILES

NORTH BRANCH AKELEY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PINE GROVE, PA

( WARREN COUNTY )

09P



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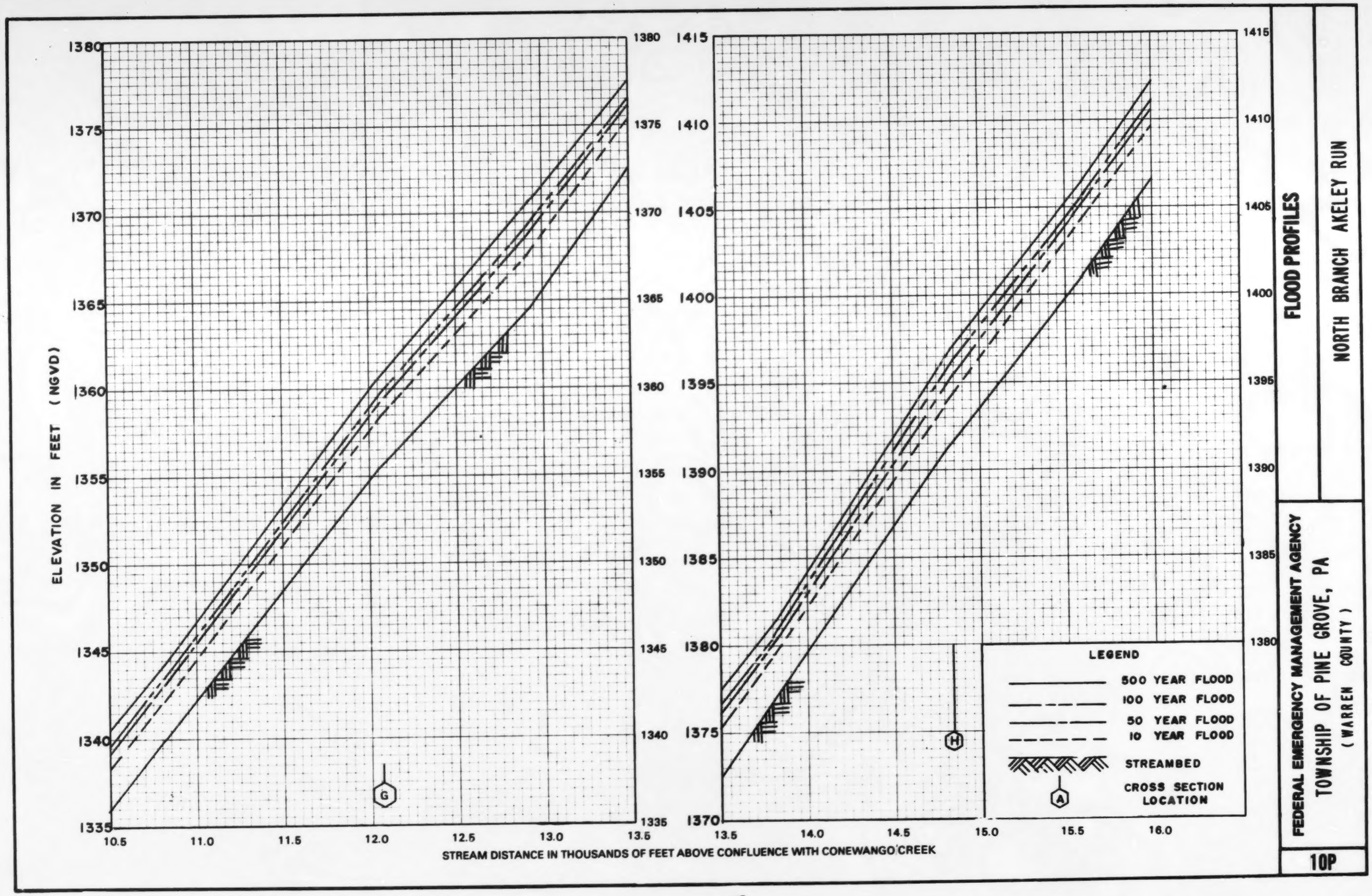


FLOOD PROFILES

NORTH BRANCH AKELEY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PINE GROVE, PA

(WARREN COUNTY)

10P



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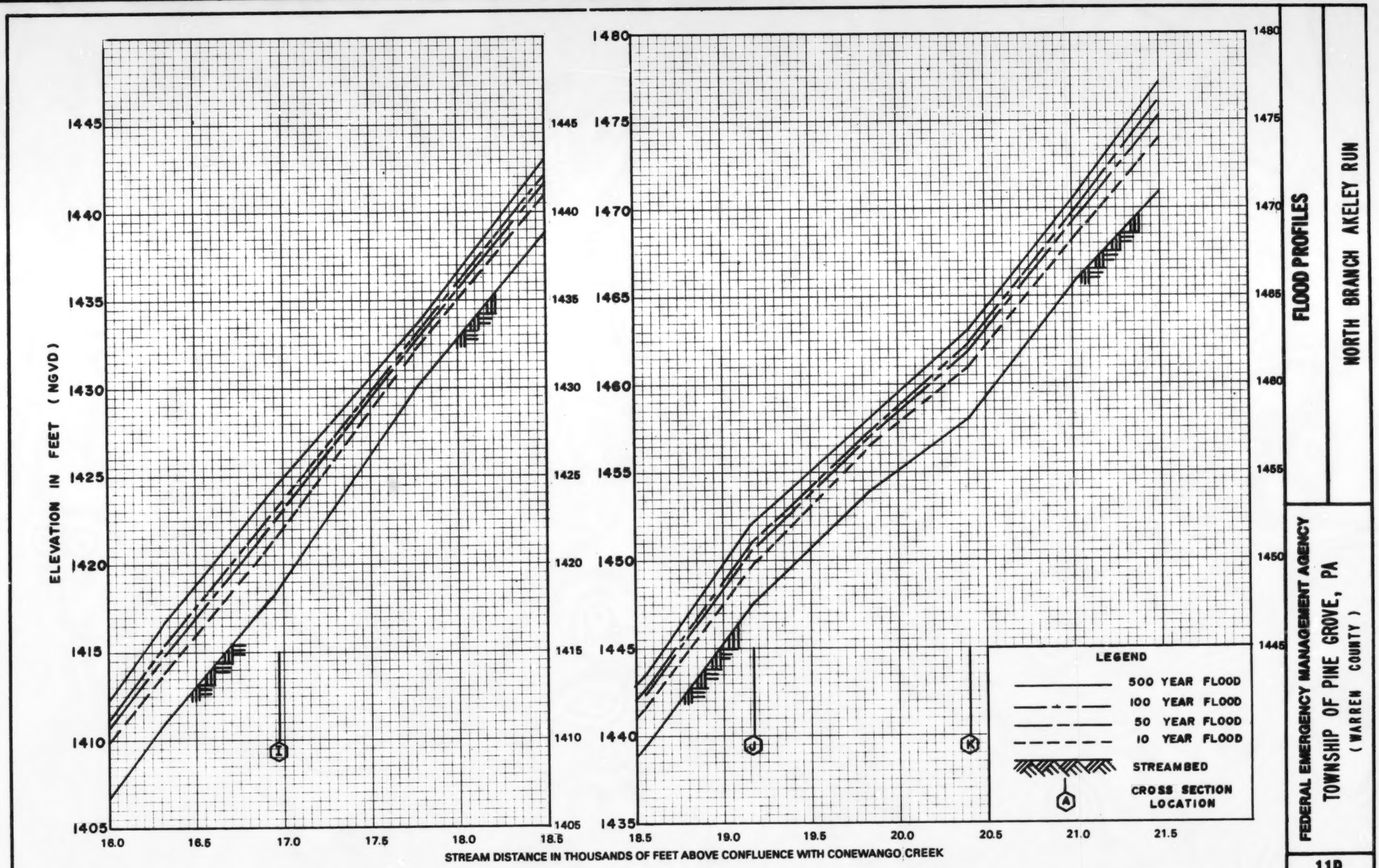


FLOOD PROFILES

NORTH BRANCH AKELEY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PINE GROVE, PA

( WARREN COUNTY )

11P



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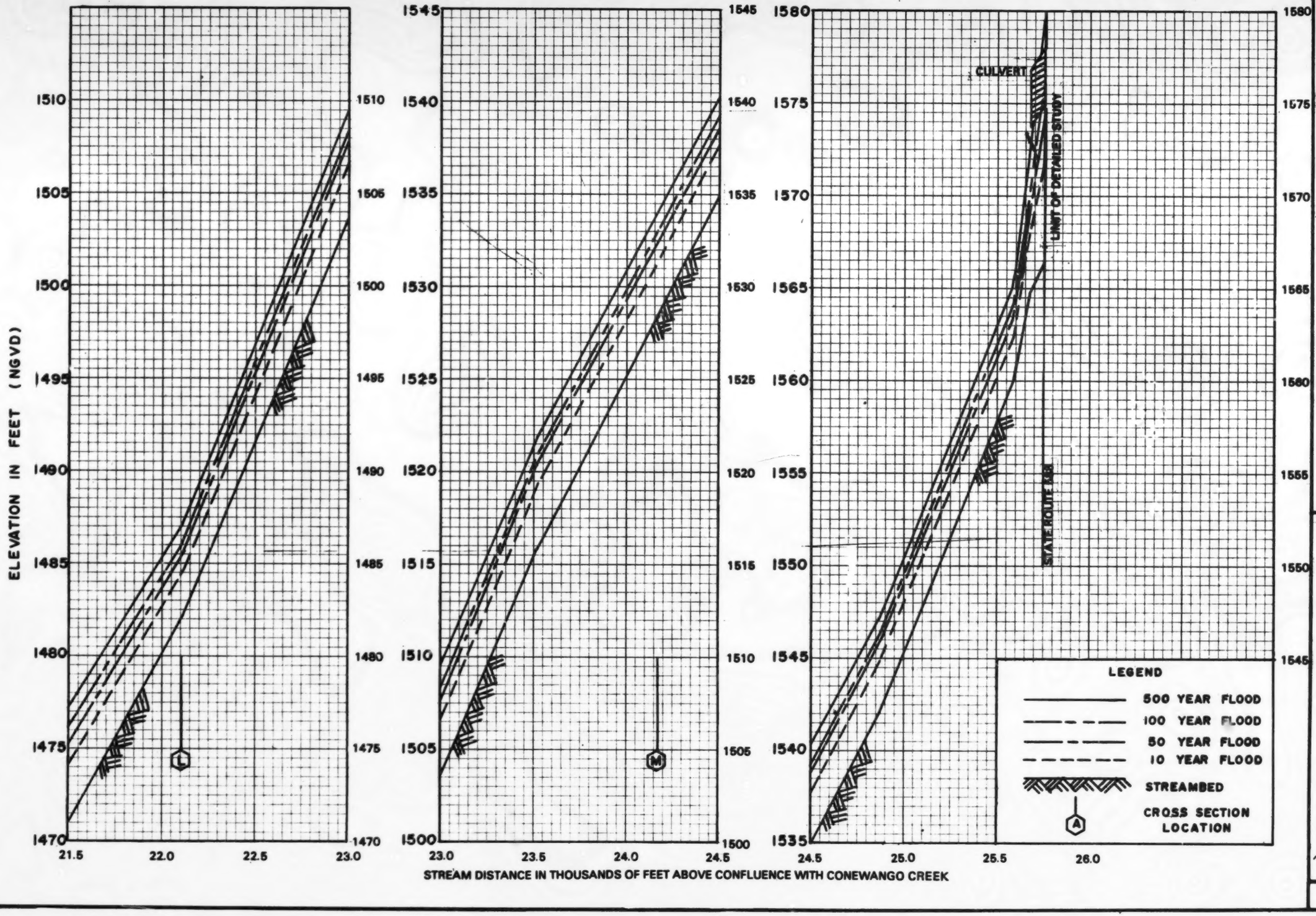


FLOOD PROFILES

NORTH BRANCH AKELEY RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF PINE GROVE, PA

( WARREN COUNTY )

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